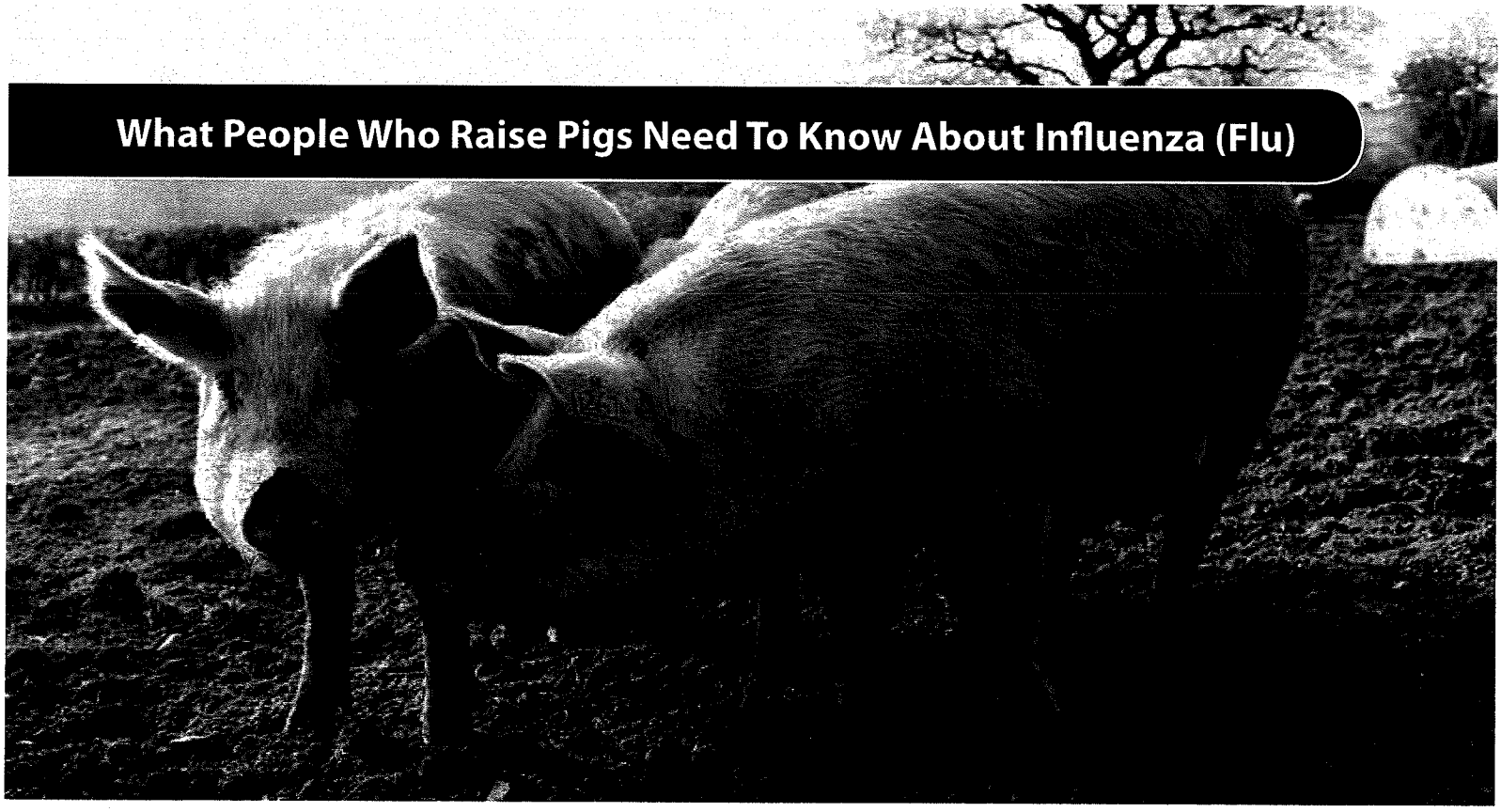
APPENDIX C

What People Who Raise Pigs Need To Know About Influenza (Flu)



Introduction

As someone who raises pigs, whether for show (e.g. 4-H or Future Farmers of America [FFA]) or as part of a farming operation (i.e. commercial pork producer), you may have questions about influenza (the flu) in both pigs and people. This document addresses what is known about flu viruses in pigs and people and what people in contact with pigs can do to reduce the risk of getting sick or of getting their pigs sick.

Influenza Virus Infections in Pigs

There are many causes of respiratory disease in pigs, including influenza. Among influenza types, only type A influenza viruses are known to infect pigs. Although pigs and people now share the H1N1 pandemic virus, other viruses circulating in swine are different from viruses circulating in people. At this time, there are three main flu A viruses that circulate in U.S. pigs: influenza A H1N1, influenza A H1N2 and influenza A H3N2. These viruses do not usually infect people and are genetically different from the H1N1 and H3N2 viruses that commonly circulate in people. When swine flu viruses are very different from the human flu viruses causing illness in people, people may have little to no immune protection against these swine viruses. Also human flu vaccines probably would not offer protection against the viruses that are found in pigs.

Flu viruses commonly infect pigs and pig herds and can result in high rates of illness among pigs, but few deaths.

Signs of influenza in pigs include:

- Coughing ("barking")
- Sneezing
- High fevers
- Breathing difficulties
- Discharge from the nose
- Going off feed

However, pigs also may become infected with flu viruses from people, and from birds. This cross-species spread and possible mixing of flu viruses can lead to new and very different flu viruses that might gain the ability to spread easily between people.

January 2012

Questions & Answers about Influenza in Pigs

Q. How does influenza spread among pigs?

A. Flu viruses are thought to spread among pigs in the same way that human influenza viruses spread among people. That is mainly through close contact between infected and uninfected pigs and possibly from contact by an uninfected pig with an object contaminated by an infected pig. Pigs also can be infected by flu viruses from their human caretakers.

Q. Can influenza virus infections be prevented in pigs?

A. It may be possible to lessen the risk of infections in pigs and/or severity of disease by following these management strategies:

- Vaccinating herds
- Using good biosecurity measures
- Practicing good hygiene
- Vaccinating pig caretakers with seasonal influenza vaccine
- Using proper ventilation systems

Q. What about flu vaccines for pigs?

A. Flu vaccines for pigs can help, but are not 100% effective. Sometimes the vaccine used may not protect against the virus or viruses circulating. In addition, current vaccines may not be effective in young pigs due to interference from antibodies received from the sow. Generally, protection of young pigs is achieved by vaccinating sows; however, those maternal antibodies are not fully protective for the young pig and decrease by the time they are 10 to 13 weeks old or sooner. Producers may vaccinate their animals after maternal antibodies decrease.

Q. How can veterinarians help?

A. You should work together with your veterinarian to develop management strategies to reduce the spread of influenza among herds and to prevent the introduction and spread of flu viruses between pigs, people, and birds.

Q. Can people get swine influenza from eating pork?

A. Swine influenza has not been shown to be transmissible to people through eating properly handled and prepared pork (pig meat) or other products derived from pigs. For more information about the proper handling and preparation of pork, visit the USDA website fact sheet "Fresh Pork from Farm to Table" at http://www.fsis.usda.gov/factsheets/Pork_From_Farm_to_Table/index.asp.

Q. What about 2009 H1N1?

A. The 2009 H1N1 flu virus was first detected in people in the United States in April 2009. It was a new influenza virus among humans which was able to spread easily from person-to-person, causing the first influenza pandemic in more than 40 years. This virus had two genes from flu viruses that normally circulate in pigs, in Europe and Asia, three genes that normally circulate in North American pigs, and genes from flu viruses from birds and people as well. This particular virus, however, had not been detected in North American pigs before April 2009. This virus is now considered a human influenza virus.

In October 2009, the first case of 2009 H1N1 flu virus infection in a pig in the United States was confirmed. Pig infections with the 2009 H1N1 flu virus also have been found in other countries, including Canada, Australia and Argentina. USDA and other researchers conducted studies in pigs that showed that the 2009 H1N1 virus caused illness in swine similar to those of other well-known, circulating swine flu viruses. The extent to which the 2009 H1N1 virus continues to infect pigs in the United States is not fully known; however, data from the USDA Swine Influenza Virus (SIV) Surveillance Program suggests the 2009 H1N1 virus may be widespread in the U.S. swine population. This was initially the result of pigs becoming infected with the virus when they came in contact with infected people after April 2009, but likely continues through pig-to-pig spread of the virus.

Q. How common are swine influenza infections in people?

A. Human infections with influenza A viruses normally found in swine (now called variant viruses) are rare events, but the frequency of such detections has increased recently. This could be occurring for a number of reasons including: improved laboratory methods for testing for these viruses in the United States, increased surveillance in the United States for influenza, or it is possible that the increased frequency of detection of variant viruses represents a true increase in the number of such cases, possibly occurring from exposure to infected swine or through subsequent, limited human-to-human transmission.

The Flu Can Spread from Pigs to People and from People to Pigs

- Human flu viruses can infect pigs and can introduce new flu viruses into the swine population.
- The flu viruses that normally circulate in pigs can infect people, but this is not common.
- In 2005 and 2006, three cases of infection with flu viruses that normally circulate in swine ("variant viruses") were reported in people.
- Beginning in 2007 about three to four of these cases were reported per year. This increased reporting may partially be because human infection with novel (non-human) flu viruses became nationally notifiable in 2007. That means that when a human infection with a non-human influenza virus is detected in people, it must be reported to federal authorities.
- In 2011, 14 cases of infection with variant viruses were reported.
- The flu viruses that commonly spread in humans are different from the ones that spread in pigs, with the exception of 2009 H1N1.
- People who get vaccinated annually against human influenza can still get sick from swine influenza viruses.
- Pigs that have been vaccinated for swine influenza can still get sick from some human influenza viruses.
- When people are infected with variant flu viruses, the symptoms are basically the same as those caused by illness from human influenza viruses and can include fever, cough, body aches, headaches, fatigue and runny or stuffy nose. There may also be vomiting or diarrhea.

- Most reported cases of human infection with variant viruses have occurred in people who have been near infected pigs in public settings such as fairs or petting zoos, or who work directly with infected pigs.
- Recent studies have shown that 15 percent to 25 percent of swine farmers in the United States may have been exposed to flu viruses common among pigs at some time in their lives, as well as about 10 percent of veterinarians.
- Investigations of human cases of infection with variant viruses are routine. These investigations are designed to determine if the flu virus in question is spreading from person to person. It is important to know if flu viruses common among pigs are spreading among people so that cases in other people can be prevented.

Prevent the Spread of Flu Viruses Between People and Pigs

Like everyone else, animal caretakers tending pigs should get annual seasonal influenza vaccines. Although vaccination of people with seasonal influenza vaccine probably will not protect against infection with swine influenza viruses (because they are substantially different from human influenza A viruses), vaccination is important to reduce the risk of transmitting seasonal influenza A viruses from ill people to other people and to pigs. Seasonal influenza vaccination might also decrease the potential for people or pigs to become co-infected with both human and swine influenza A viruses. Such dual infections are thought to be the source of reassortment of two different influenza A viruses which can lead to a new influenza A virus that has a different combination of genes, and which could pose a significant public or animal health concern.

Other routine measures to take:

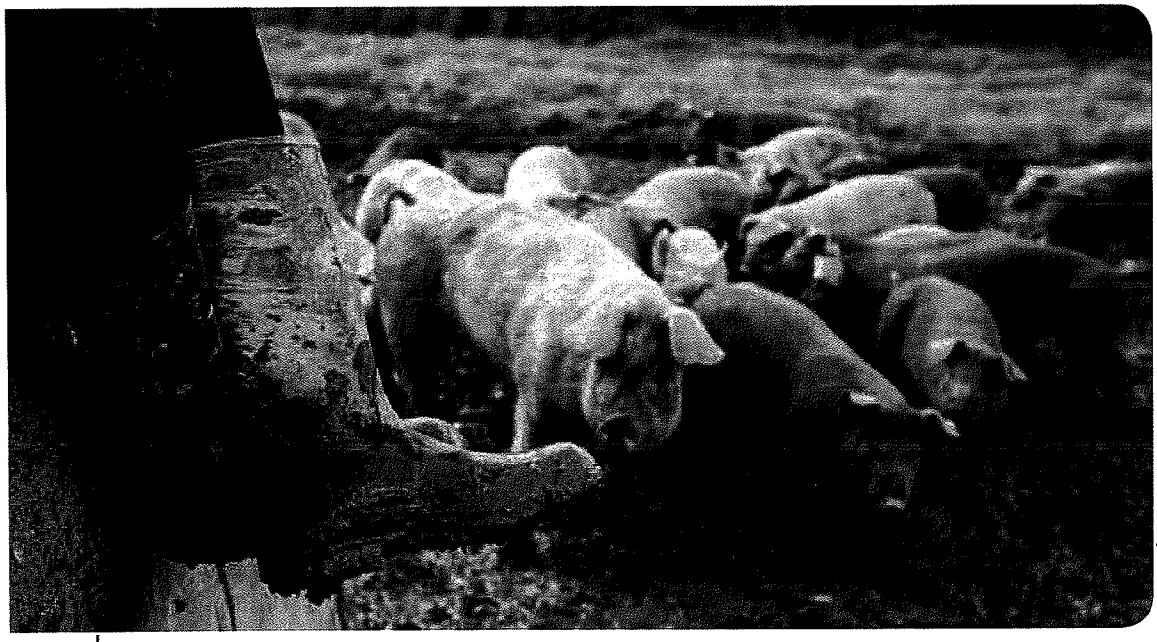
- Wash your hands frequently with soap and running water before and after exposure to animals,
- Avoid close contact with animals that look or act ill, when possible, and
- Avoid contact with pigs if you are experiencing flu-like symptoms.

If you must come in contact with pigs while you are sick, or if you must come in contact with pigs known or suspected to be infected, or their environment, you should use appropriate protective measures (for example, wear protective clothing, gloves, masks that cover your mouth and nose, and other personal protective equipment) and practice good respiratory and hand hygiene (see next page).

If you or your family members become sick with flu-like symptoms and need medical treatment, take the following steps:

- Contact your health care provider and let them know about your symptoms and that you work with swine. Your doctor may prescribe treatment with influenza antiviral medications and may want a nose and throat specimen collected from you for testing at your state health department.
- Avoid or limit contact with household members and others while you are sick, and avoid travel.
- Practice good respiratory and hand hygiene. This includes covering your mouth and nose with a tissue when coughing or sneezing and putting used tissues in a waste basket. If tissues are not available, cough or sneeze into your upper sleeve. Always wash your hands after coughing or sneezing. This is to lower the risk of spreading whatever virus you have to others.
- Avoid or limit contact with pigs as much as possible. Stay away from pigs for 7 days after symptoms begin or until you have been fever-free for 24 hours without the use of fever reducing medications, whichever is longer. (This is to protect your pig(s) from getting sick.)

Almost all influenza cases in humans are caused by human flu viruses, not viruses from swine. However, if you are infected with an influenza virus of animal origin, the health department will want to talk with you about your illness and make sure that other people you live and work with are not sick with the same virus.



For more information, visit:

http://www.cdc.gov/flu/swineflu/

http://www.aphis.usda.gov/animal_health/animal_dis_spec/swine/siv_surv_manual.shtml

http://www.cfsph.iastate.edu/Factsheets/pdfs/swine_influenza.pdf

http://www.porknetwork.com/pork/smart-thinking/The-Changing-Face-of-Swine-Influenza-Virus-133249878.html#

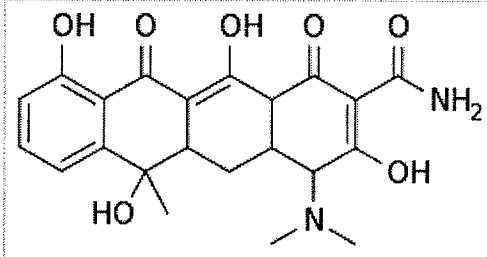
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
U.S. Department of Agriculture

Tetracycline antibiotics

From Wikipedia, the free encyclopedia

Tetracyclines are a group of broad-spectrum antibiotics whose general usefulness has been reduced with the onset of antibiotic resistance. Despite this, they remain the treatment of choice for some specific indications.

They are so named for their four ("tetra-") hydrocarbon rings ("-cycl-") derivation ("-ine"). To be specific, they are defined as "a subclass of polyketides having an octahydrotetracene-2-carboxamide skeleton".[1] They are collectively known as "derivatives of polycyclic naphthacene carboxamide".



The 4 rings of the basic tetracycline structure.

Wikimedia Commons has media related to ***Tetracycline antibiotics***.

Contents

Medical uses

Tetracyclines are generally used in the treatment of infections of the urinary tract, respiratory tract, and the intestines and are also used in the treatment of chlamydia, especially in patients allergic to β-lactams and macrolides; however, their use for these indications is less popular than it once was due to widespread development of resistance in the causative organisms.

Their most common current use is in the treatment of moderately severe acne and rosacea (tetracycline, oxytetracycline, doxycycline or minocycline).

Doxycycline is also used as a prophylactic treatment for infection by *Bacillus anthracis* (anthrax) and is effective against *Yersinia pestis*, the infectious agent of bubonic plague. It is also used for malaria treatment and prophylaxis, as well as treating elephantitis filariasis.[2]

Tetracyclines remain the treatment of choice for infections caused by chlamydia (trachoma, psittacosis, salpingitis, urethritis and *L. venereum* infection), Rickettsia (typhus, Rocky Mountain spotted fever), brucellosis and spirochetal infections (borreliosis, syphilis and Lyme disease). In addition, they may be used to treat anthrax, plague, tularemia and Legionnaires' disease. They are also used in veterinary medicine.

They may have a role in reducing the duration and severity of cholera, although drug-resistance is mounting [3] and their effect on overall mortality is questioned.[4]

Tetracycline derivatives are currently being investigated for the treatment of certain inflammatory disorders.

Side effects

Side-effects from tetracyclines are not common, but of particular note is phototoxicity. It increases the risk of sunburn under exposure to light from the sun or other sources. This may be of particular importance for those intending to take on vacations long-term doxycycline as a malaria prophylaxis.

They may cause stomach or bowel upsets, and, on rare occasions, allergic reactions. Very rarely, severe headache and vision problems may be signs of dangerous secondary intracranial hypertension, also known as pseudotumor cerebri.

Tetracyclines are teratogens due to the likelihood of causing teeth discolouration in the fetus as they develop in infancy. For this same reason, tetracyclines are contraindicated for use in children under 8 years of age. Some adults also experience teeth discoloration (mild grey hue) after use. They are, however, safe to use in the first 18 weeks of pregnancy.[5][6]

Some patients taking tetracyclines require medical supervision because they can cause steatosis and liver toxicity.[7][8][9]

Cautions

Tetracyclines should be used with caution in those with liver impairment and those that are soluble in water and urine worsen renal failure (this is not true of the lipid-soluble agents doxycycline and minocycline). They may increase muscle weakness in myasthenia gravis and exacerbate systemic lupus erythematosus. Antacids containing aluminium and calcium reduce the absorption of all tetracyclines, and dairy products reduce absorption greatly for all but minocycline.

The breakdown products of tetracyclines are toxic and can cause Fanconi syndrome, a potentially fatal disease affecting proximal tubular function in the nephrons of the kidney. Prescriptions of these drugs should be discarded once expired because they can cause hepatotoxicity.

It was once believed that tetracycline antibiotics impair the effectiveness of many types of hormonal contraception. Recent research has shown no significant loss of effectiveness in oral contraceptives while using most tetracyclines. Despite these studies, many physicians still recommend the use of barrier contraception for people taking any tetracyclines to prevent unwanted pregnancy.[10][11][12]

Contraindications

Tetracycline use should be avoided in pregnant or lactating women, and in children with developing teeth because they may result in permanent staining (dark yellow-gray teeth with a darker horizontal band that goes across the top and bottom rows of teeth), and possibly affect the growth of teeth and bones.

Usage during the first 12 weeks of pregnancy does not appear to increase the risk of any major birth defects.[13] There may be a small increased risk for minor birth defects such as an inguinal hernia, but the number of reports is too small to be sure if there actually is any risk.[13]

In tetracycline preparation, stability must be considered in order to avoid formation of toxic epi-anhydrotetracyclines.

Mechanism of action

Tetracycline antibiotics are protein synthesis inhibitors, inhibiting the binding of aminoacyl-tRNA to the mRNA-ribosome complex. They do so mainly by binding to the 30S ribosomal subunit in the mRNA translation complex.[14]

Tetracyclines also have been found to inhibit matrix metalloproteinases. This mechanism does not add to their antibiotic effects, but has led to extensive research on chemically modified tetracyclines or CMTs (like incyclinide) for the treatment of rosacea, acne, diabetes and various types of neoplasms.[15][16][17] Incyclinide was announced to be ineffective for rosacea in September 2007.[18]

Several trials have examined modified and unmodified tetracyclines for the treatment of human cancers; of those, very promising results were achieved with CMT-3 for patients with Kaposi Sarcoma.[19]

Mechanism of resistance

Tetracycline inhibits cell growth by inhibiting translation. It binds to the 16S part of the 30S ribosomal subunit and prevents the amino-acyl tRNA from binding to the A site of the ribosome. The binding is reversible in nature.

Cells become resistant to tetracycline by at least three mechanisms: enzymatic inactivation of tetracycline, efflux, and ribosomal protection. Inactivation is the rarest type of resistance, where an acetyl group is added to the molecule, causing inactivation of the drug. In efflux, a resistance gene encodes a membrane protein that actively pumps tetracycline out of the cell. This is the mechanism of action of the tetracycline resistance gene on the artificial plasmid pBR322. In ribosomal protection, a resistance gene encodes a protein that can have several effects, depending on what gene is transferred. Six classes of ribosomal protection genes/proteins have been found, all with high sequence homology, suggesting a common evolutionary ancestor.

Possible mechanisms of action of these protective proteins include:

1. blocking tetracyclines from binding to the ribosome
2. binding to the ribosome and distorting the structure to still allow t-RNA binding while tetracycline is bound
3. binding to the ribosome and dislodging tetracycline.

All of these changes to ribosomes are reversible (non-covalent) because ribosomes isolated from both

tetracycline-resistant and susceptible organisms bind tetracycline equally well *in vitro*.

Administration

When ingested, it is usually recommended that the more water-soluble, short-acting tetracyclines (plain tetracycline, chlortetracycline, Oxytetracycline, demeclocycline and methacycline) be taken with a full glass of water, either two hours after eating or two hours before eating. This is partly because most tetracyclines bind with food and also easily with magnesium, aluminium, iron and calcium, which reduces their ability to be completely absorbed by the body. Dairy products, antacids and preparations containing iron should be avoided near the time of taking the drug. Partial exceptions to these rules occur for doxycycline and minocycline, which may be taken with food (though not iron, antacids, or calcium supplements). Minocycline can be taken with dairy products because it does not chelate calcium as readily, although dairy products do decrease absorption of minocycline slightly.[20]

History

The first member of the group to be discovered is Chlortetracycline (Aureomycin) in the late 1940s by Benjamin Minge Duggar, a scientist employed by American Cyanamid - Lederle Laboratories, under the leadership of Yellapragada Subbarow, who derived the substance from a golden-colored, fungus-like, soil-dwelling bacterium named *Streptomyces aureofaciens*.[21] Oxytetracycline (Terramycin) was discovered shortly afterwards by AC Finlay et al.; it came from a similar soil bacterium named *Streptomyces rimosus*.[22] Robert Burns Woodward determined the structure of Oxytetracycline enabling Lloyd H. Conover to successfully produce tetracycline itself as a synthetic product.[23] The development of many chemically altered antibiotics formed this group. In June 2005, tigecycline, the first member of a new subgroup of tetracyclines named glycylcyclines, was introduced to treat infections that are resistant to other antimicrobics including conventional tetracyclines.[24] While tigecycline is the first tetracycline approved in over 20 years, other, newer versions of tetracyclines are currently in human clinical trials.[25]

A research conducted by anthropologist George J. Armelagos and his team at Emory University showed that ancient Nubians from the post-Meroitic period (around 350 CE) had deposits of tetracycline in their bones, detectable through analyses of cross sections through ultraviolet light - the deposits are fluorescent, just as modern ones. Armelagos suggested that this was due to ingestion of the local ancient beer (very much like the Egyptian beer[26]), made from contaminated stored grains.[27]

Examples

According to source:

- Naturally occurring
  - Tetracycline
  - Chlortetracycline
  - Oxytetracycline
  - Demeclocycline
- Semi-synthetic
  - Lymecycline

- Meclocycline
- Methacycline
- Minocycline
- Rolitetracycline

According to duration of action:

- Short-acting (Half-life is 6-8 hrs)
  - Tetracycline
  - Chlortetracycline
  - Oxytetracycline
- Intermediate-acting (Half-life is ~12 hrs)
  - Demeclocycline
  - Methacycline
- Long-acting (Half-life is 16 hrs or more), allowing to be used one or twice daily only
  - Doxycycline
  - Minocycline
  - Tigecycline

Tigecycline may also be considered a tetracycline antibiotic, though it is usually classified as a glycylcycline antibiotic.

Experimental tetracyclines in clinical trials

- Omadacycline (formerly known as PTK-0796[28]) in phase III clinical trials for Acute Bacterial Skin and Skin Structure Infections and Community Acquired Bacterial Pneumonia[29]
- Sarecycline (formerly known as WC 3035) in phase III clinical trials for Acne Vulgaris.[30]

Use as a research reagent

Members of the tetracycline class of antibiotics are often used as research reagents in *in vitro* and *in vivo* biomedical research experiments involving bacteria as well in experiments in eukaryotic cells and organisms with inducible protein expression systems using tetracycline-controlled transcriptional activation. The mechanism of action for the antibacterial effect of tetracyclines relies on disrupting protein translation in bacteria, thereby damaging the ability of microbes to grow and repair; however protein translation is also disrupted in eukaryotic mitochondria leading to effects that may confound experimental results.[31][32]

See also

- Glycylcycline
- Tetracycline controlled transcriptional activation
- Animal Drug Availability Act 1996

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Categories: Tetracycline antibiotics | Acne treatments

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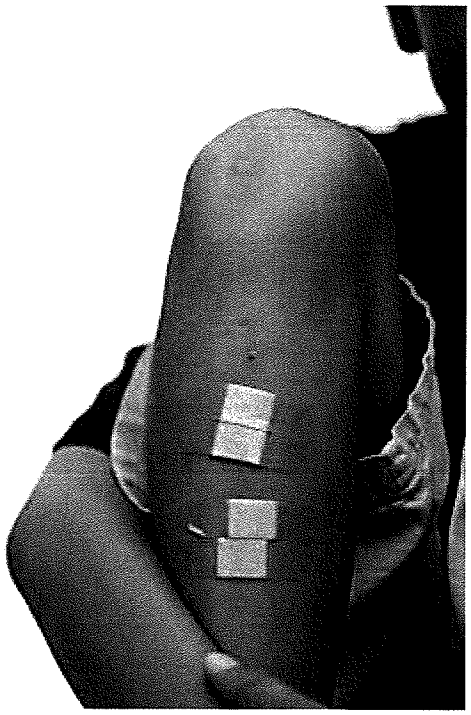
General Information About MRSA in the Community



MRSA is methicillin-resistant *Staphylococcus aureus*, a type of staph bacteria that is resistant to several antibiotics. In the general community, MRSA most often causes skin infections. In some cases, it causes pneumonia (lung infection) and other issues. If left untreated, MRSA infections can become severe and cause sepsis (http://www.cdc.gov/sepsis) - a life-threatening reaction to severe infection in the body.

In a healthcare setting, such as a hospital or nursing home, MRSA can cause severe problems such as bloodstream infections (http://www.cdc.gov/HAI/bsi/bsi.html), pneumonia (http://www.cdc.gov/HAI/vap/vap.html) and surgical site infections (http://www.cdc.gov/HAI/ssi/ssi.html). For more information visit MRSA in healthcare settings (http://www.cdc.gov/mrsa/healthcare/index.html).

Who Is At Risk, and How Is MRSA Spread In The Community?

Anyone can get MRSA on their body from contact with an infected wound or by sharing personal items, such as towels or razors, that have touched infected skin. MRSA infection risk can be increased when a person is in activities or places that involve crowding, skin-to-skin contact, and shared equipment or supplies. People including athletes, daycare and school students, military personnel in barracks, and those who recently received inpatient medical care are at higher risk.

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How Common Is MRSA?

Studies show that about one in three people carry staph in their nose, usually without any illness. Two in 100 people carry MRSA. There are not data showing the total number of people who get MRSA skin infections in the community.

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Can I Prevent MRSA? How?

There are the steps you can take to reduce your risk of MRSA infection:

- Maintain good hand and body hygiene. Wash hands often, and clean your body regularly, especially after exercise.
- Keep cuts, scrapes and wounds clean and covered until healed.
- Avoid sharing personal items such as towels and razors.
- Get care early if you think you might have an infection.

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What are MRSA Symptoms?

Sometimes, people with MRSA skin infections first think they have a spider bite. However, unless a spider is actually seen, the irritation is likely not a spider bite. Most staph skin infections, including MRSA, appear as a bump or infected area on the skin that might be:

- Red
- Swollen
- Painful
- Warm to the touch
- Full of pus or other drainage
- Accompanied by a fever

Click here for photos of MRSA infections (photos/index.html).

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What Should I Do If I See These Symptoms?

If you or someone in your family experiences these signs and symptoms, cover the area with a bandage, wash your hands, and contact your doctor. It is especially important to contact your doctor if signs and symptoms of an MRSA skin infection are accompanied by a fever.

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What Should I do if I Think I Have a Skin Infection?

- You can't tell by looking at the skin if it is a staph infection (including MRSA).
- Contact your doctor if you think you have an infection. Finding infections early and getting care make it less likely that the infection will become severe.
- Do not try to treat the infection yourself by picking or popping the sore.
- Cover possible infections with clean, dry bandages until you can be seen by a doctor, nurse, or other health care provider.

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How To Prevent Spreading MRSA

- Cover your wounds. Keep wounds covered with clean, dry bandages until healed. Follow your doctor's instructions about proper care of the wound. Pus from infected wounds can contain MRSA so keeping the infection covered will help prevent the spread to others. Bandages and tape can be thrown away with the regular trash. Do not try to treat the infection yourself by picking or popping the sore.
- Clean your hands often. You, your family, and others in close contact should wash their hands often with soap and water or use an alcohol-based hand rub, especially after changing the bandage or touching the infected wound.
- Do not share personal items. Personal items include towels, washcloths, razors and clothing, including uniforms.
- Wash used sheets, towels, and clothes with water and laundry detergent. Use a dryer to dry them completely.
- Wash clothes according to manufacturer's instructions on the label. Clean your hands after touching dirty clothes.

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Division of Healthcare Quality Promotion (DHQP) (/ncezid/dhqp/index.html)